

ON THE TREATMENT OF OLD DISLOCATIONS
OF THE ELBOW.¹

By LEWIS A. STIMSON, M.D.,

OF NEW YORK.

SURGEON TO THE PRESBYTERIAN AND BELLEVUE HOSPITALS

THE great extension given in the last few years to the application of operative methods to the treatment of surgical diseases and injuries has compelled a reopening of many questions which had been previously looked upon as settled, and has made it necessary again to collect and study the recorded experience for our guidance in the future.

Among these questions, that relating to the propriety of interference in old, unreduced dislocations is an important one, and one upon which experience is rapidly accumulating, and among these dislocations, those of the elbow have an important place. The loss of mobility resulting from the injury, especially in the common dislocation of both bones backward, is usually so great that the disability is serious, the patient is unable to bring the hand to the head or chest, and is able to use it only in the arc of a circle whose radius is nearly equal to the length of the extended limb, and he may in addition possess only such rotation as can be effected by movements at the shoulder. Moreover, the injury is most common in the young, and the disability, therefore, is life-long. I desire to present to the society a brief review of a personal case, in which features of interest and importance appear, and a survey of the recent experience of others.

My case is as follows:

Maggie F., a rather delicate-looking girl æt. 11 years, was admitted to the Bellevue Hospital in April, 1886, with a backward dislocation of both bones of the right forearm, which had been produced five months previously by a fall from a sofa. The elbow was flexed at an angle of 150°, and was immovable, with the exception of some rotation. The soft parts covering the joint were normal in appearance and to the

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touch, and it was possible to recognize by palpation the relations of the bones, and that the internal epicondyle was lacking, while the external condyle was greatly thickened posteriorly, overlapping the concave surface of the head of the radius. The length of time that had elapsed since the injury was received, the extensive new formation of bone, and the degree of the disability, led me to attempt to relieve the condition by an arthrotomy. Dr. McBurney and Dr. Halsted were present and assisted at the operation. An incision was begun on the outer aspect of the arm about two inches above the epicondyle, was carried down to and a little beyond the latter, and was continued for a short distance along the forearm, parallel to and a little in front of the radius, and through this the mass of bone of new formation on the back of the external condyle was freely exposed and chiseled away. This mass grew backward and downward from the upper portion of the posterior aspect of the external condyle and the shaft above it, completely overlapping posteriorly the head of the radius in the form of a buttress, against which the latter rested, and was continuous on its outer and inferior margins with the condensed soft parts which formed the new capsule. The anterior part of the capsule, which was drawn snugly around the lower end of the humerus, and easily separated from it, and the articular cartilage of the latter appeared smooth and unaltered, but the dissection behind the humerus was made very difficult by the interposition of a mass of fibrous tissue between it and the greater sigmoid cavity, which entirely filled, and was closely adherent to, the latter. Dr. McBurney advised the making of a second incision upon the inner side of the elbow to facilitate this dissection, but, unfortunately, I preferred to meet the difficulty by dividing the olecranon, being encouraged so to do by the reports of some cases to be subsequently mentioned, and by personal experience of the method in operations for tuberculous disease of the joint. So the incision was extended across the olecranon, and this process was divided obliquely at its thinnest part. The back of the condyles was then easily freed, and the epitrochlea was found to have been broken off and to have become reunited with the humerus at some distance above its normal position. The attached internal lateral ligament was then separated from it, and the bones were then readily brought into place. The coronoid process of the ulna had not been broken.

The olecranon was sutured with silk-worm gut. A drainage tube was placed behind the condyles through the external incision, the wound was closed, and the limb was placed in a splint with the elbow at an angle of 145° . It was possible to flex it to a right angle, but in that position the strain exerted by the triceps upon the olecranon was

so great as to endanger its reunion. As the history will show, in thus seeking to avoid failure of union, the occurrence of another and more serious accident, which I did not anticipate, was favored—recurrence of the dislocation. Two days later the dressings were changed and the limb was enveloped in plaster-of-Paris bandages. A week later a fenestrum was cut and the tube was removed; there was little or no sup-puration. During the following month I was absent from the city: on my return, the dressing was removed and the wound was found to be solidly healed, but the dislocation had recurred. A second operation was done three weeks later, two months after the first. A curved incision was made, its convexity upward, beginning just below the outer side of the head of the radius and crossing above the olecranon; the ulnar nerve was exposed and drawn aside, and the joint was opened by cutting through the triceps. The joint-surfaces were found to be almost denuded of cartilage and much changed in shape by bony and fibrous outgrowths at their borders; so I excised the lower end of the humerus and the head of the radius; the bone was much softer than usual. I enlarged the sigmoid cavity by scraping, and cut a notch in the lower end of the humerus to receive the olecranon; catgut drains were introduced. Close fibrous union of the former division of the olecranon was found. The wound healed without incident in thirteen days; passive motion was made for several weeks, and the patient left the hospital with flexion to within a right angle and almost complete extension, but, on looking her up in February, 1887, about seven months later. I found the joint completely ankylosed at a right angle. The only good results of the operation was an improvement in the attitude, and against that must be offset the loss of the slight amount of rotation that existed before the operation. There is still the possibility of restoring motion by another excision, but I advised the parents not to have that done at present.

The direct examination of the joint at the two operations disclosed several interesting features of which some are new and others have been before described, which bear directly upon the question of the best method of treatment. The extensive overgrowth of bone upon the back of the external condyle has not, I think, been observed, or at least reported, in any other case in which the dislocation had existed for only five months, and it is to be attributed, probably, to the stripping up of the periosteum. It may be remembered that a specimen of incomplete outward dislocation, in a child æt. 8

years, removed by excision and presented to the society, October 25, 1886, by Dr. Lange, showed a similar growth nearly half an inch broad, on the outer aspect of the external condyle—one probably produced in the same manner. Taken in connection with avulsion of the epitrochlea, which is common in lateral dislocations outward, but rare in backward ones, and the apparent integrity of at least the outer part of the anterior ligament, it suggests that the dislocation was produced not by the usual hyperextension of the elbow, but rather by a lateral outward flexion of the forearm, which tore off the epitrochlea, and was then followed by a twist, which carried the coronoid process backward past the trochlea, and then by a direct impulsion of the bones backward and upward. Displaced in this manner, it is easy to understand that the head of the radius should have stripped the external lateral ligament from its attachment to the condyle, and should have passed upward between the periosteum and the bone, leaving the former continuous more or less completely with the ligament, and itself remaining within the cavity thus formed. That the periosteum thus stripped up should so promptly have produced the mass of bone found above and behind the head of the radius is entirely in harmony with our experience. To this extent the case is exceptional; but other features are of more general occurrence, and may reasonably be looked for under like circumstances. The attitude of almost complete extension of the forearm is common, and the consequent overriding of the bones along the back of the humerus leads to the formation of new cicatricial bands between the olecranon and the humerus, and to the establishment of new attachments of the torn lateral ligaments so far above and behind the center of motion that almost no flexion is possible without their rupture or elongation, and the return of the bones to their place can be effected only after a far more extensive rupture of these soft parts than that which accompanied the dislocation. In attempting to rupture these bands by forced flexion, the forearm is used as a lever, the fulcrum of which is situated in the ulna below the coronoid process, and the rupturing strain is exerted through the olecranon upon the ligaments and adhesions connected with it, and it is not to be

wondered at that this process should so frequently have been broken in the manipulation. In the case which I have described, the middle and posterior portions of the internal lateral ligament apparently had not been ruptured, but had been torn away at their upper attachment, remaining continuous with the fragment of the epitrochlea, and, after this fragment had reunited with the humerus at a higher point, the ligament was as strong as it had ever been.

The filling of the greater sigmoid cavity by a mass of fibrous tissue, partly of new formation and partly furnished by the posterior portion of the capsule which slips in between it and the bone, appears to be of frequent occurrence; it has been encountered in several operations, and the union between this mass and the cartilage of incrustation was so firm in my case, as also in others, as to require the application of the edge of the knife for its removal. When present, it must be a serious, perhaps an insurmountable, obstacle to the restoration of the bones to their place by any method which does not directly provide for its removal. The adhesion of the anterior portion of the capsule to the cartilage covering the capitellum was but slight, and the cartilage itself was almost unaltered in appearance after the separation. The reason of this notable difference in the solidity of the adhesions contracted by the cartilage covering the greater sigmoid cavity and that covering the capitellum is not clear.

Another change peculiar to the young, which was present in only a slight degree if at all, in my case, is one which may so far alter the shape of the end of the humerus, and particularly of the capitellum, as to make it impossible to replace the radius and ulna, even after the removal of all obstacles arising from the change in the soft parts. This change, which has rarely been noted at the elbow, is of common occurrence at the knee in the subluxations following prolonged flexions of that joint. It consists in an exaggerated growth of the epiphysis consequent upon the withdrawal of the pressure normally exerted upon it by the opposing articular surfaces, and, as the conjugate cartilage of the capitellum runs obliquely from in front and above downward and backward, this growth takes place in a direction at right angles to that of this cartilage—

that is, downward and forward—and the capitellum subsequently forms an abnormally large hemispherical prominence on the anterior and lower part of the bone. The epiphysis of the trochlea is smaller than that of the capitellum, forming only a comparatively thin scale upon the surface, and there are no observations to show any inequality in its growth due to this cause. In the reported cases in which the capitellum was deformed, the ulna had remained more or less completely in contact with the trochlea, and consequently the factor of withdrawal of normal pressure did not exist for it. In Dr. Lange's specimen, above mentioned, the capitellum showed this enlargement very plainly, but the inner side of the trochlea was flattened.

Another change, which has been observed only in cases of displacement of very long standing, is elongation of the neck of the radius, and this also, I think, must be attributed to the same cause. Reported specimens, in which one or both changes have been observed, are those of Humphrey, Allen and R. W. Smith, but in none of them is it certain that the primary displacement was a traumatic dislocation. In Humphrey's case the lower part of the left ulna was lacking, evidently the result of defective development; the right ulna was firmly ankylosed to the humerus nearly at a right angle, and was eight inches long; its lower end was well formed, and was on the usual level with the radius. The latter was also eight inches long, and its head was displaced upward and rested against "the fore part of the ridge that ascends from the outer condyle to the shaft;" it was somewhat irregular in shape, and its extra length was developed in its shaft, and not in its neck, as in other cases. The displacement upward was clearly the result of the elongation of the radius, whatever the cause of the original displacement from contact with the capitulum may have been, whether traumatic, pathological or congenital.

Allen's specimen was taken from the body of an elderly man, without a history. Both elbows were affected, flexion was normal, extension possible only to a right angle, rotation

¹Humphrey, "*Medico-chirurg. Trans.*," vol. xiv, p. 296.

was entirely lost, the limbs being fixed in pronation. The radius crossed the front of the ulna and was united with it by bony union for a distance of about three inches at their upper part; below this part the shaft of the radius was much thickened. The neck of the radius was an inch and a half long, so that the head was carried well up behind the humerus on the inner side of the olecranon, and this overriding was further increased by the abnormal growth of the external condyle downward and outward, the extent downward of the growth being estimated at half an inch. The trochlear surface was deformed, mainly by the loss of its inner lip. The olecranon was so far filled up that the septum between it and the coronoid fossa was one-third of an inch thick.¹ In R. W. Smith's specimen, which was taken from a woman about 40 years old, the radius was displaced forward, and the external condyle was much larger than usual and was bent forward, its anterior upper surface forming with the lesser sigmoid cavity of the ulna, a deep hollow in which the head of the radius lay.²

Finally, partial fractures of the head of the radius and of the coronoid process have been observed in dislocations backward, and the presence of the fragment of the radius or the formation of bony union between the stump of the coronoid process and the humerus may interfere with reduction. In several cases the fracture of the head of the radius has caused so much disability that resort has been had to arthrotony,³ and in two cases of backward dislocation of both bones Annandale⁴ found the coronoid process united to the back of the humerus "by a considerable amount of osseous material.

To recapitulate: In all cases of backward dislocation of both bones of the forearm, of more than a month's or six weeks' standing, it may be reasonably assumed that strong adhesions have formed between the olecranon and the stump of the external lateral ligament and the back and sides of the humerus, which must be ruptured or divided before the bones can be returned to their place, and that the greater sigmoid

¹Allen, "Glasgow Med. Jour." 1880, vol. xiv, p. 44.

²Smith, "Dublin Quart. Jour. of Med. Sci.," 1850, vol. x, p. 213.

³Wagner, "Beilage zum Centralblatt f. Chirurgie," 1886, No. 24.

⁴Annandale, "Edinburgh Med. Jour.," February, 1885, p. 16.

cavity is occupied by a closely adherent mass of fibrous tissue; and when the patient is under 15 years of age it is probable that the lower end of the humerus has been altered in shape by the formation of new bone under the injured periosteum on its back or sides, and by the exaggerated growth of the capitellum. When the dislocation has lasted three months or more in a young patient, this deformity of the capitellum may be quite marked, and may be made still more important by an elongation of the neck of the radius. It is possible also, though not probable, that there may be present a partial fracture of the head of the radius or of the coronoid process, which will seriously interfere with the restoration of the functions of the joint even after the reduction of the dislocation.

Turning now to the bearing of these changes upon the question of treatment, it appears that they are clearly incompatible with successful reduction by the means employed in fresh cases, even if the force employed be sufficient to rupture the adhesions and to bring the bones down to the proper level. It is true that successes have been occasionally reported, but the reports rarely go beyond the statement that reduction was accomplished, and they leave the subsequent history of the case and the degree of re-establishment of the functions unrecorded. Until quite recently the only methods employed have been forcible attempts to reduce by traction and the breaking of adhesions, sometimes aided by subcutaneous division of the tendon of the triceps, or of the adhesions on the side and back of the joint, increase of the range of motion by the same means without reduction, reduction after fracture of the olecranon by forcible flexion, and excision of the joint.

Albert says that Liston, more than forty years ago, successfully reduced an old dislocation after having subcutaneously divided all tense bands, and that, in 1847, Blumhardt successfully practiced arthrotomy in a similar case, making two lateral incisions, and dividing through them all the adhesions that opposed reduction. This case appears to have been entirely lost sight of, and it was not until thirty years later (in 1877) that Küster,¹ in reporting a case of fracture and dislocation of the

¹"Berliner klin. Wochenschrift," 1877, p. 16.

astragalus treated by excision, suggested that old dislocations of other joints might be successfully treated by arthrotomy. In the following year Trendelenburg,¹ in a paper recommending temporary division of the olecranon to facilitate operations upon the elbow joint, reported a case of incomplete outward, or outward and backward, dislocation of both bones, with avulsion of the epitrochlea, which he had treated by making an incision along the tendon of the biceps, and chiseling away enough bone from the lower end of the humerus in front of the coronoid process to allow flexion to a right angle; the result was good to that extent. A little later Volker² reported a case of incomplete outward dislocation of the left elbow, of six months' standing, in a boy, æt. 13 years, in which, after division of the olecranon, he had divided the adhesions, dissected away the new tissue adherent to the sigmoid fossa, and had then been able to reduce; as the change in the shape of the bones favored recurrence, he also removed the head of the radius. He then sutured the olecranon with two silk-worm gut sutures, passed from side to side of the bone, closed the wound and obtained a good result. His incision was V-shaped, its sides extending along the borders of the triceps, and the bottom of the V crossing the olecranon at the point where it was to be divided. The position of the limb (ankylosis in almost complete extension) and the evidences of serious pressure upon the ulnar nerve were important factors in the determination to operate. He was so pleased with the result that he looked forward with confidence to the adoption of the method in all old dislocations with much disability.

Trendelenburg³ promptly claimed priority in the suggestion of preliminary division of the olecranon, and reported a case of backward dislocation of both bones of eight weeks' standing, successfully treated in this manner. His incision was a curved transverse one, the convexity directed upward, crossing the median line well above the olecranon, and the flap of skin was then dissected and reflected downward to the point at which the olecranon was to be divided; the division was done

¹"Arch. f. klin. Chir." 1879, vol. xxiv, p. 790.

²"Deutsche Zeitschrift f. Chir." 1880, vol. 12, p. 541.

³"Centralblatt f. Chir." 1880, p. 833.

with a chisel. Because of difficulty in bringing the olecranon down, the limb was dressed in extension, but after the nineteenth day, when the wound was healed, the position was gradually changed, and four weeks after the operation the limb could be flexed to a right angle. The olecranon reunited solidly in this case and in Volker's.

In 1885, Nicoladoni¹ published a short paper on the application of arthrotomy to old dislocations of various joints, and included in it the report of two cases in which he had practiced it at the elbow. The first case was an almost complete outward dislocation of the left elbow, in a lad æt. 16, which had existed for eight months; the epitrochlea was broken off and drawn under the trochlea; the limb was in extension, flexion was almost entirely lost, but rotation was preserved. An incision 8 centimetres long was made in front, along the inner border of the trochlea, and through this the fractured epitrochlea was removed; a second incision of the same length was made on the outer side of the joint, through which, after removal of a small piece of bone which had been broken from the condyle, the soft parts were separated from the radius and the humerus; then, through a longitudinal cut made in the triceps, the adhesions between the olecranon and the back of the humerus were separated, and the bones were then easily restored to place. The wounds healed after slight suppuration; passive motion was begun after the third week, and the patient was dismissed after seven and a half weeks, with the elbow flexed and movable through an arc of 35° or 40°. Nine months later he wrote that he could flex and extend the joint freely, but that rotation was not quite so free. The second patient was a large, powerful man, æt. 41 years, with a backward dislocation that had existed for six months. The limb was almost completely extended and immovable: there was no passive rotation. Two lateral incisions, each 16 centimetres long, were made; through the first, over the outer condyle, in front of the head of the radius, the soft parts were separated from the bone, leaving the periosteum undisturbed, into the trochlea and above the fossa trochlearis in front and behind;

¹"Wiener Med. Wochenschrift," 1885, p. 728.

the separation from the cartilage was easy in front, but very difficult behind. Through the second incision, on the inner side of the elbow, the flexor muscles were cut away close in front of the epitrochlea, and the separation of the soft parts from the bone was completed. The greater sigmoid cavity was found to be filled with hard cicatricial tissue, which was cut and scraped away, after separation of the posterior attachment of the orbicular ligament. Reduction was then easily made. Two drains were placed on the flexor side of the joint, and one through the tendon of the triceps; the wound was closely sutured, a Lister dressing was applied, and the limb was placed on a splint. Recovery took place without incident, and the patient was dismissed at the end of four weeks, the wounds being almost healed. There was good active rotation, but very little flexion; passively, there was complete extension and flexion to a right angle.

In drawing conclusions from this scanty record of only five cases, we may be somewhat aided by the results of similar operations at other joints, and in other dislocations at the elbow. In several (five or six) cases of isolated dislocation of the head of the radius, arthrotomy has been done with good results, both as regards the reduction of the dislocation and the restoration of function, although the latter has never been complete. I know of only one case (Burkhardt's) in which a dislocation at the shoulder has been reduced by arthrotomy, and in this the functional result left much to be desired. In another (Albert's) fracture of the surgical neck of the humerus took place during the operation, and the patient recovered with pseudarthrosis, and in a third (Thiersch's) the operation failed. At the ankle the astragalus has been successfully replaced by arthrotomy by Dr. McBurney, in a recent dislocation; and the operation has been done several times with success at the metacarpal joint of the thumb. In a case of thyroid dislocation of the hip, Polaillon¹ lost his patient by acute septicæmia. In a case of dorsal dislocation, of nine months' standing, in a child æt. 7 years, Dr. McBurney successfully reduced by arthrotomy, but the head of the femur subse-

¹"Bull. de la soc. de chir.," 1873, p. 101.

quently became carious and was removed. The success in Volker's and Trendelenburg's cases in which the olecranon was divided, was fairly good, and the divided process reunited promptly and well; but in mine the union was only fibrous, and the fixation of the upper fragment was such that the limb had to be dressed in semi-extension, and to this I attribute the recurrence of the displacement. Probably the difficulty might have been avoided by a more free liberation of the upper fragment, from which I refrained because I did not think it necessary and did not anticipate the consequence which followed. The method gave easy access to the joint and a good view of the adhesions that needed to be divided; but in another case I should give the preference to the method by two lateral incisions, without division of the olecranon.

The only facts in this brief record that may actually contraindicate resort to arthrotomy are the death of Polaillon's patient, and the change in the articular cartilage observed at the second operation in my case. Of the former it is sufficient to say that the case was of six weeks' standing, and had been subjected to several attempts to reduce under chloroform, the last one three weeks before the operation, and that the region of the hip was still tender and swollen; the patient was delicate and alcoholic. The incision was made in front, from the anterior inferior spine of the ilium downward, and during the operation the dislocation was transformed into a dorsal one. Apparently, the operation was done with scrupulous attention to antiseptic details, and the occurrence of fatal acute septicæmia (with emphysematous gangrene) was probably due to extensive bruising and laceration of the soft parts; the record of the case indicates that the parallel between it and the operations upon tissues that have recently been subjected to violent traumatism is close.

The change in the articular cartilage observed in my case could hardly have been caused by the inflammatory reaction following the operation, for that was not sensibly greater or more prolonged than after the original dislocation. I am inclined to attribute it rather to the keeping of the knife too close to the bone in the separation and freeing of the soft parts, and I think, therefore, that in a similar case it would be

better to divide the adhesions than to separate them from the humerus. The reported cases are too few to justify much generalization, but the large measure of success which they have furnished is an encouragement to further trial. In the mean time the rules of conduct in the presence of old backward dislocation of the elbow formulated by Albert appear to be judicious. He says that in elderly patients he limits interference to rupture or subcutaneous division of the adhesions, and that, if reduction then fails, he forcibly flexes the elbow to a right angle, with or without fracture of the olecranon, and allows it to become ankylosed in that position. In younger patients he makes the attempt to reduce, sometimes dividing the tendon of the triceps, so as to avoid fracturing the olecranon; reduction failing, he does an arthrotomy, with two lateral incisions, and, if this also fails, he proceeds to resection.

To this I should wish to add the caution that arthrotomy should not be undertaken until after the tissues have entirely recovered from the inflammatory reaction or the fresh lacerations of the original injury, or of attempts to reduce; and that the longer the dislocation has lasted, and the younger the patient (under 15 years), the less is the probability that arthrotomy will be sufficient and the greater is the probability that excision will be required. In old, incomplete outward dislocations little good is to be hoped for from anything but arthrotomy, for the common interposition of the fractured epitrochlea cannot otherwise be overcome, or the cicatricial obstacles on the inner side be removed. The choice will, probably, lie between improving the attitude by forcible flexion of the limb, if extended, and arthrotomy, the internal incision being made in front of the trochlea, rather than upon the side.